State of Illinois
Department of Registration and Education
STATE GEOLOGICAL SURVEY DIVISION
John C. Frye, Chief

GUIDE LEAFLET

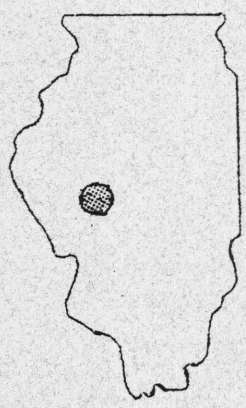
GEOLOGICAL SCIENCE FIELD TRIP

Sponsored by
ILLINOIS STATE GEOLOGICAL SURVEY, URBANA

PETERSBURG AREA

Menard County

Petersburg, Tallula, and Mason City Quadrangles



Leaders
William Cote, David Reinertsen, and George Wilson
Urbana, Illinois
May 13, 1967

GUIDE LEAFLET 1967 B HOST: Porta Community High School

PETERSBURG GEOLOGICAL SCIENCE FIELD TRIP

Introduction

The Petersburg area is situated in Menard County on the stream-dissected Illinoian till plain, just south of a broad triangular-shaped alluvial plain extending along the Illinois Valley from Pekin to Beardstown called the Havana Lowland. The area was glaciated during the Kansan (about 700,000 to 600,000 years ago) and the Illinoian (about 250,000 to 200,000 years ago) Stages of the Pleistocene Epoch. Kansan ice-laid deposits (till) are widespread through the area but are deeply buried beneath younger drift and rarely exposed. Thick valley trains of Kansan and Illinoian sand and gravel occur in the buried bedrock valleys which cross the area. Illinoian till extensively underlies the present uplands and is exposed in many places.

The Wisconsinan glaciation (70,000 to 5,000 years ago), reached only as far as southwestern Tazewell County at its maximum extent and did not cover the Petersburg area. However, enormous quantities of outwash were deposited in the valleys of the Salt Creek, Illinois, Mackinaw, and Sangamon Rivers by meltwater from the Wisconsinan glacier. During Wisconsinan time, prevailing westerly winds also blew great amounts of fine sand and silt from these valleys. Sand dunes were formed in the Havana Lowland and on the adjacent bluffs, and an extensive, thick blanket of clay and silt (loess) was deposited over the uplands.

The glacial deposits in the Petersburg area are thickest over the Middletown and Athens bedrock valleys where they exceed 200 feet in many places. On the uplands away from these ancient valleys, the glacial deposits average about 100 feet in thickness, varying somewhat according to the irregularity of the bedrock surface. Because of the great thickness of the glacial deposits, the bedrock surface generally has little expression on the present topography in the Petersburg area. Throughout most of Menard County the uplands and interstream divides are flat. This flat terrain is typical of the Illinoian till plain in central Illinois. Near the present valleys the terrain is rugged and hilly because of stream erosion. In the field trip area the topography of the upland immediately south and west of the Sangamon River valley is quite hilly and rolling because of the numerous sand ridges and dunes that were formed during the Wisconsinan glaciation.

Bedrock immediately beneath the glacial drift in Menard County consists of sedimentary rocks (limestone, sandstone, shale, and coal) of Pennsylvanian age (about 300 million years old) (fig. 1). These rocks and older formations of Mississippian, Devonian, Silurian, Ordovician, and Cambrian ages were deposited in the ancient seas which periodically covered the Midwest during the Paleozoic Era (between about 550 and 270 million years ago). These Paleozoic strata, which have a cumulative thickness of about 4500 feet in the field trip area, rest upon an ancient Precambrian basement of granitic rocks, more than one billion years old. The strata are tilted gently downward to the southeast (fig. 2) and thicken to more than 10,000 feet into the deepest part of the Illinois Basin in southeastern Illinois (see attached Geologic Map of Illinois).

The only mineral resource presently being exploited in Menard County is limestone for use as roadstone and agricultural lime. In the past, coal has been mined, and as recently as 1965 the county produced 5355 tons of coal valued at $20,028. Coal remains a potentially valuable resource in the Petersburg area. Pennsylvanian shales have been utilized in the past for the manufacture of clay products and are still a potentially valuable mineral resource.

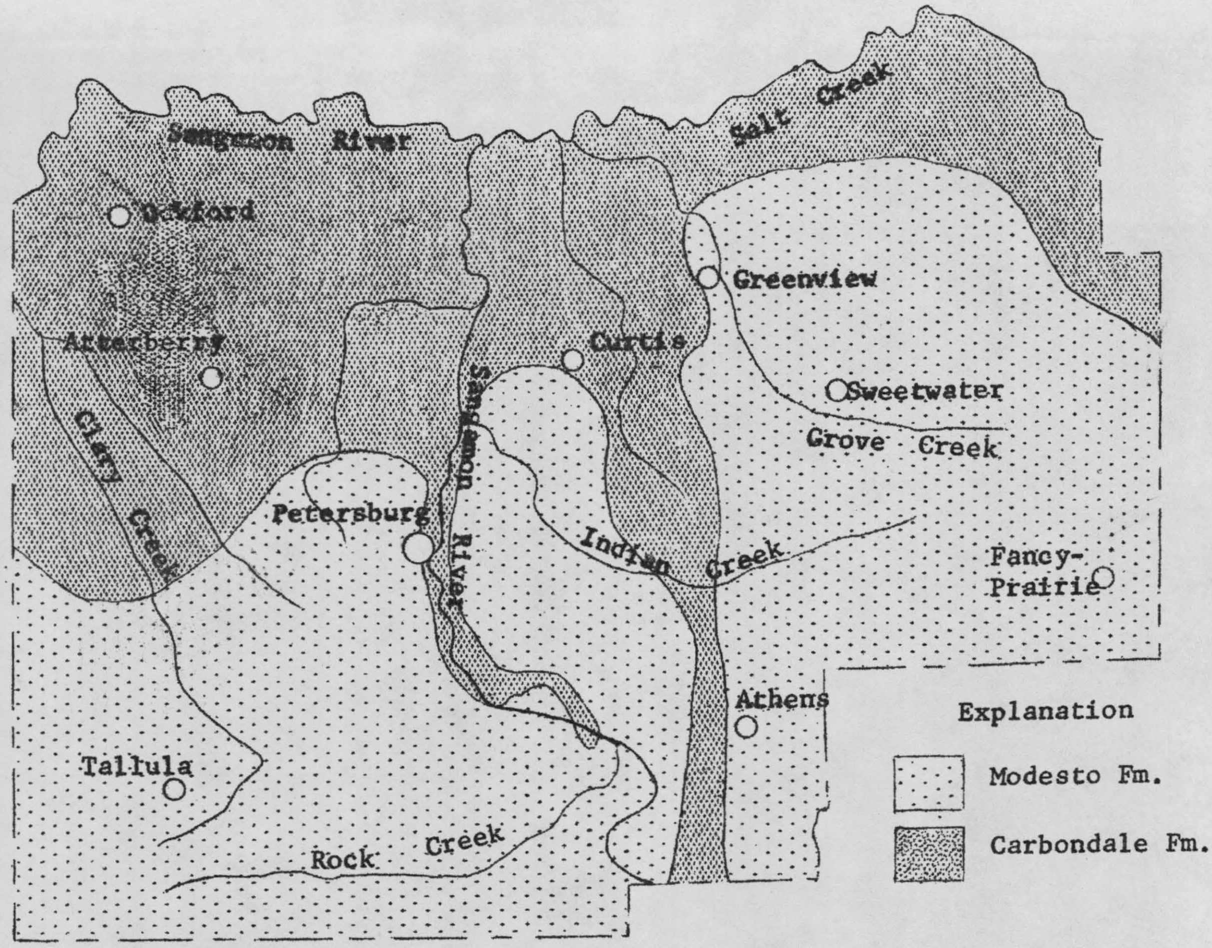


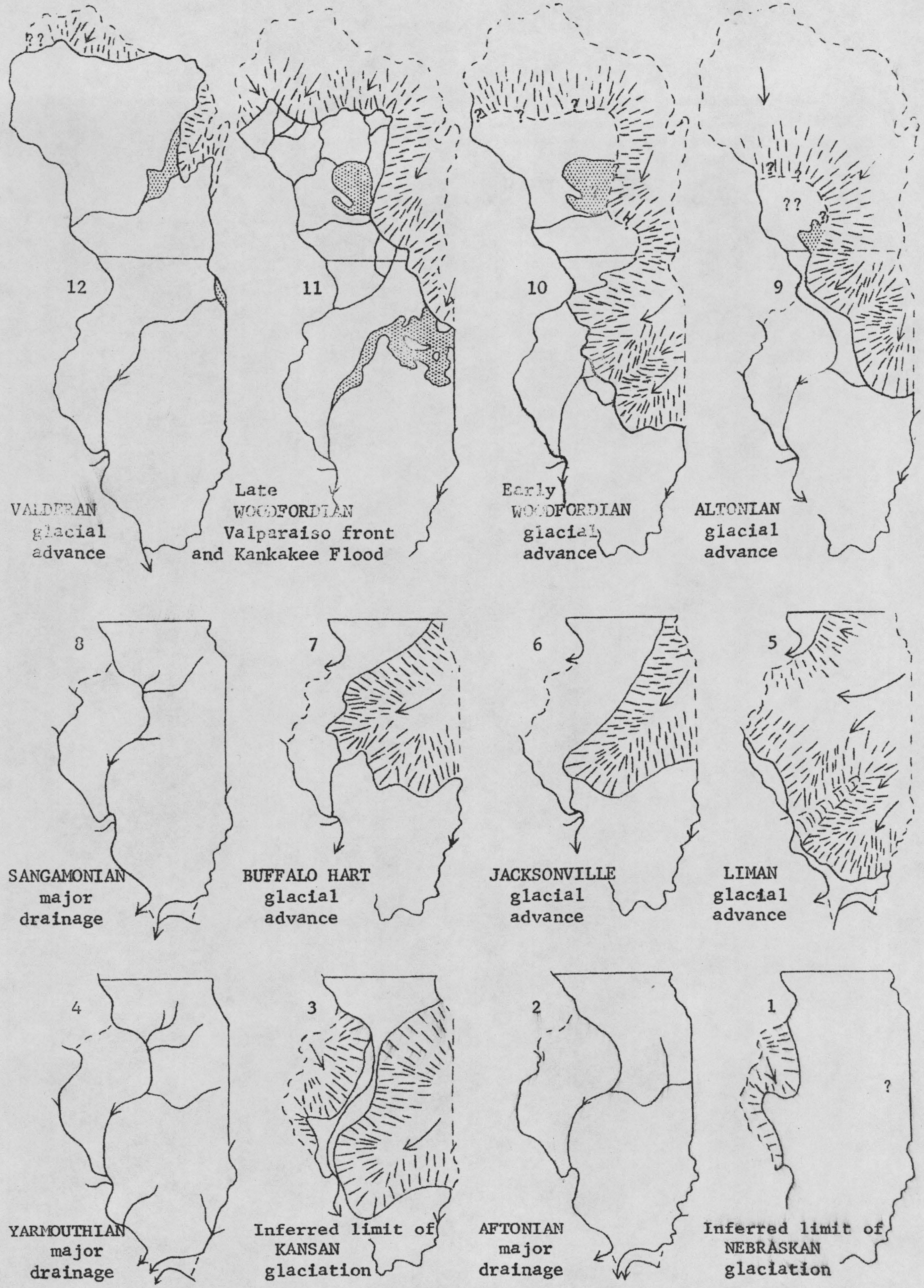
Fig. 1 - Generalized geologic map of the Pennsylvanian bedrock beneath the unconsolidated surficial deposits, Menard County, Illinois.

Glacial History of Illinois

A knowledge of Illinois glacial history and the glacial deposits is necessary for full appreciation of many points of geologic interest in the Petersburg area. The following summary is a brief introduction to these subjects and should be read before the field trip begins.

Thousands of years ago much of northern North America was covered by huge glaciers. These glaciers, which advanced from centers in eastern and central Canada, developed when the mean annual temperatures were a few degrees lower than they are now, and the winter snows did not completely melt during the summers. After many years a sheet of ice accumulated that was so thick its weight caused it to flow outward, carrying with it the soil and rocks on which it rested and over which it moved.

The Pleistocene Epoch or "Great Ice Age" began about one million years ago and ended about five thousand years ago. During this epoch, there were four major stages of glaciation, each followed by a long interglacial stage characterized by climatic conditions much as they are today (see diagram on next page and attached Pleistocene Time Table in back of guide leaflet).



Pleistocene Glacial and Interglacial Intervals in Illinois

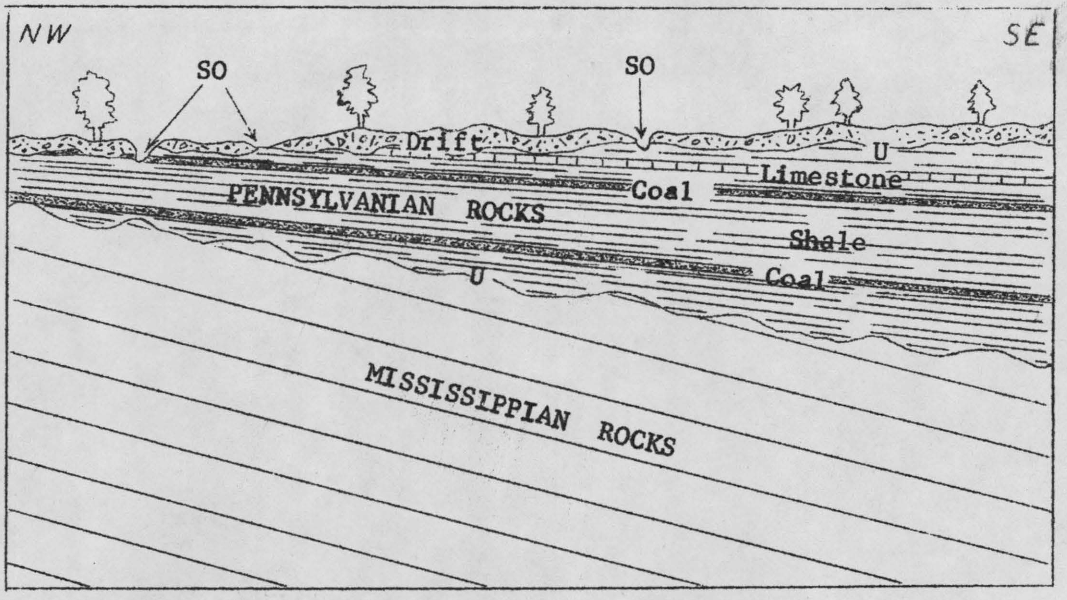


Fig. 2 - Generalized diagram showing the relation of Pennsylvanian strata to the underlying Mississippian rocks and the overlying Pleistocene unconsolidated drift. Not drawn to scale. "U" - Erosional unconformities at bottom and top of Pennsylvanian. "SO" - Surface outcrop of Pennsylvanian bedrock, usually found in stream valleys.

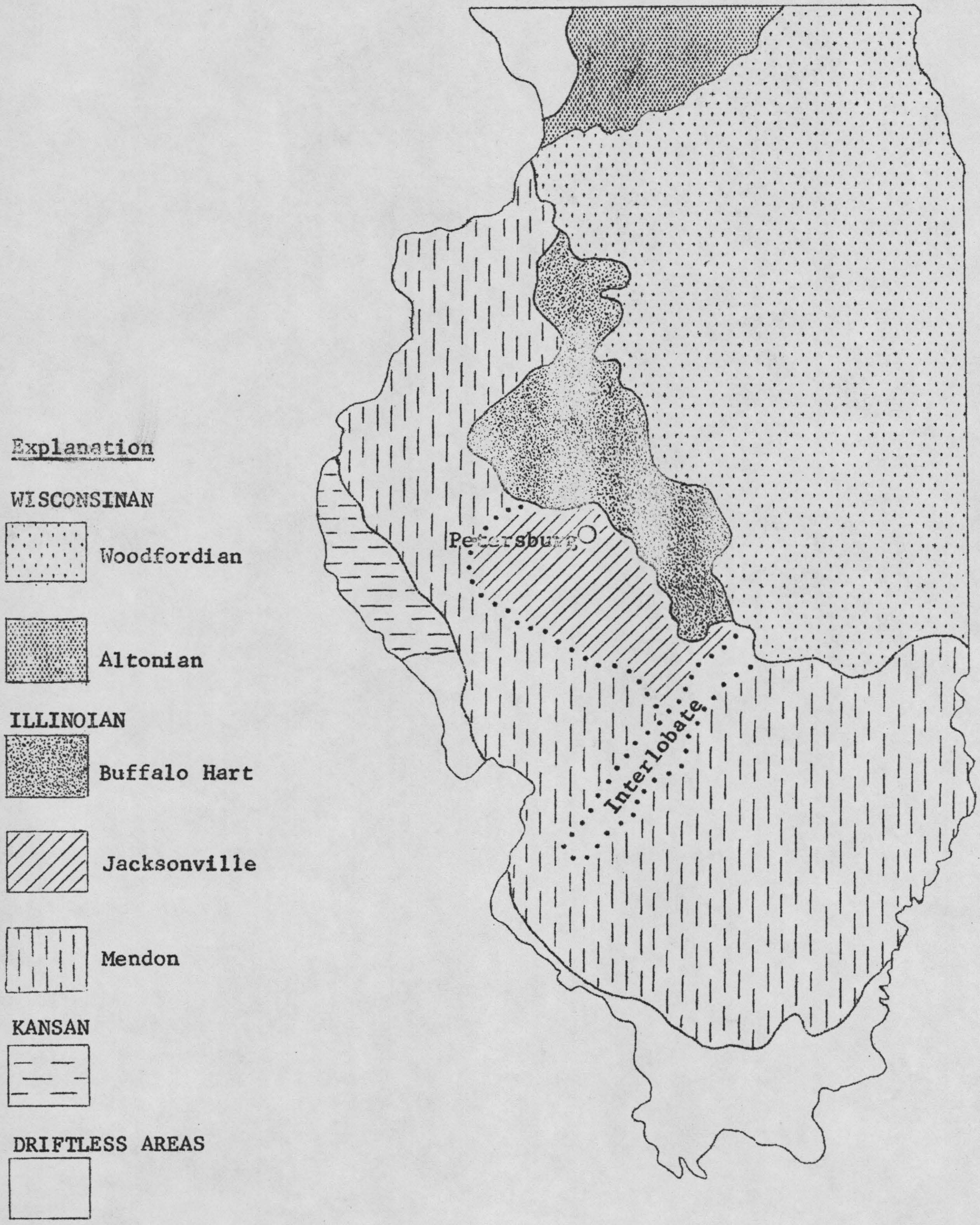
The oldest glacial stage is the Nebraskan, named after the state of Nebraska where extensive Nebraskan deposits are buried beneath the younger glacial deposits. In Illinois the Nebraskan deposits are also buried, and there are only rare exposures of Nebraskan till in extreme western Illinois. A warm climatic interval, called the Aftonian (interglacial) Stage, followed the melting of the Nebraskan glacier.

The next glacial climate produced the Kansas glacier, which left thick deposits of fine rock materials and outwash sand and gravel in Illinois when it melted away. The Kansan Stage was followed by the Yarmouthian (interglacial) Stage. During this stage, erosion carved valleys and hills, and soils were formed in the Kansas deposits.

The third glacial stage, the Illinoian, is particularly important to the residents of Illinois. The Illinoian glacier, in three separate advances (Liman, Jacksonville, Buffalo Hart), covered 80 percent of the state, reaching southward to Carbondale and Harrisburg. After several thousand years, a warm stage caused the Illinoian ice sheet to melt. During this warm stage, the Sangamonian, the upper part of the deposits left by the glacier was weathered and soil developed, as in the preceding Yarmouthian interval. These ancient Sangamonian soils resemble present-day soils in color, texture, and depth, suggesting that the climate during interglacial times was similar to our present climate.

The last and most recent glacial stage in Illinois was the Wisconsinan, which began about 70,000 years ago. The Wisconsinan comprised three major glacial advances—the Aftonian, the Woodfordian, and the Valderan. Little is known about the extent of the Altonian glacier, as its deposits were overridden by later glaciers, except in northern Illinois. The Woodfordian glacier advanced southward from

Generalized diagram showing the areas of Illinois underlain by tills of the Kansan, Illinoian, and Wisconsinan Stages. The Nebraskan Stage does not occur as surficial drift. The older tills can be traced beneath the younger tills in the subsurface.



the Lake Michigan basin to the present sites of Shelbyville, Decatur, Charleston, and Peoria. The Valderan glacier reached its maximum extent near Milwaukee, Wisconsin, and did not enter Illinois.

When the glaciers melted, they released the rock materials they had picked up as they advanced. These materials are called glacial drift. Some of the glacial drift was washed out with the meltwaters and is called outwash. The coarsest material (gravel, sand) carried by the meltwater was deposited nearest the front, and the finer material (silt, clay) was carried farther away, with some possibly carried all the way to the sea. Where the outwash was spread widely along the front of the glacier, it formed an outwash plain. Where the outwash was restricted to the stream valleys, it formed valley train deposits. Many valley trains in Illinois are buried beneath younger glacial drift.

Glacial drift deposited directly by the ice is called till. It is unsorted and unstratified and consists of a mixture of all kinds and sizes of rock fragments. As the Wisconsinan glacier wasted away, the ice front melted back and readvanced many times, creating a complex sequence of till deposits in northeastern Illinois, the most outstanding of which are end moraines. More than 50 successive end moraines were formed by the Wisconsinan glacier in Illinois alone. The major ones are shown on the accompanying glacial map of northeastern Illinois.

An end moraine is an accumulation of drift at the ice margin when the rate of advance and the rate of melting of a glacier are essentially in balance. As more and more rock debris is brought to the edge of the glacier, it piles up and forms a ridge.

The surface relief of end moraines is generally greater than that of the surrounding area and is referred to as swell-and-swale or knob-and-kettle topography. At some places there are large gaps in the moraines where subglacial streams presumably carried away most of the drift. The flatter areas behind end moraines are called ground moraines or till plains.

At times, especially in the fall and winter, the meltwaters subsided, exposing the valley trains. The wind picked up silt and fine sand from the floodplains and dropped these materials on the bluffs and uplands to form deposits of loess. Loess mantles most of Illinois. Near the large river valleys it may be as much as 60 to 80 feet thick, but it thins rapidly away from the valleys.

The importance of the Pleistocene Epoch to Illinois is emphasized by the rich soils formed from the glacial deposits and by the abundant deposits of sand and gravel. The glacial outwash, especially buried valley trains, is an important source of ground water. The state would not have these valuable resources if the glaciers had not invaded Illinois.

Glacial History of the Valleys in Central Illinois

During early Pleistocene time the central Illinois region was drained by a different river system than the present one (fig. 3). These ancient rivers, which occupied the Mahomet, Mackinaw, Middletown, and Lower Illinois Valleys, came into existence during the early part of the Nebraskan Stage. The immediate field trip area was crossed by the Middletown Valley, the Athens Valley, and a smaller tributary to the Middletown Valley. During the Nebraskan Stage, the Aftonian Stage, and the early part of the Kansan Stage, the streams entrenched their valleys deeply (as much as 200 feet) below the bedrock surface. Thick deposits of glacial drift deposited by the continental glaciers which covered the region during the

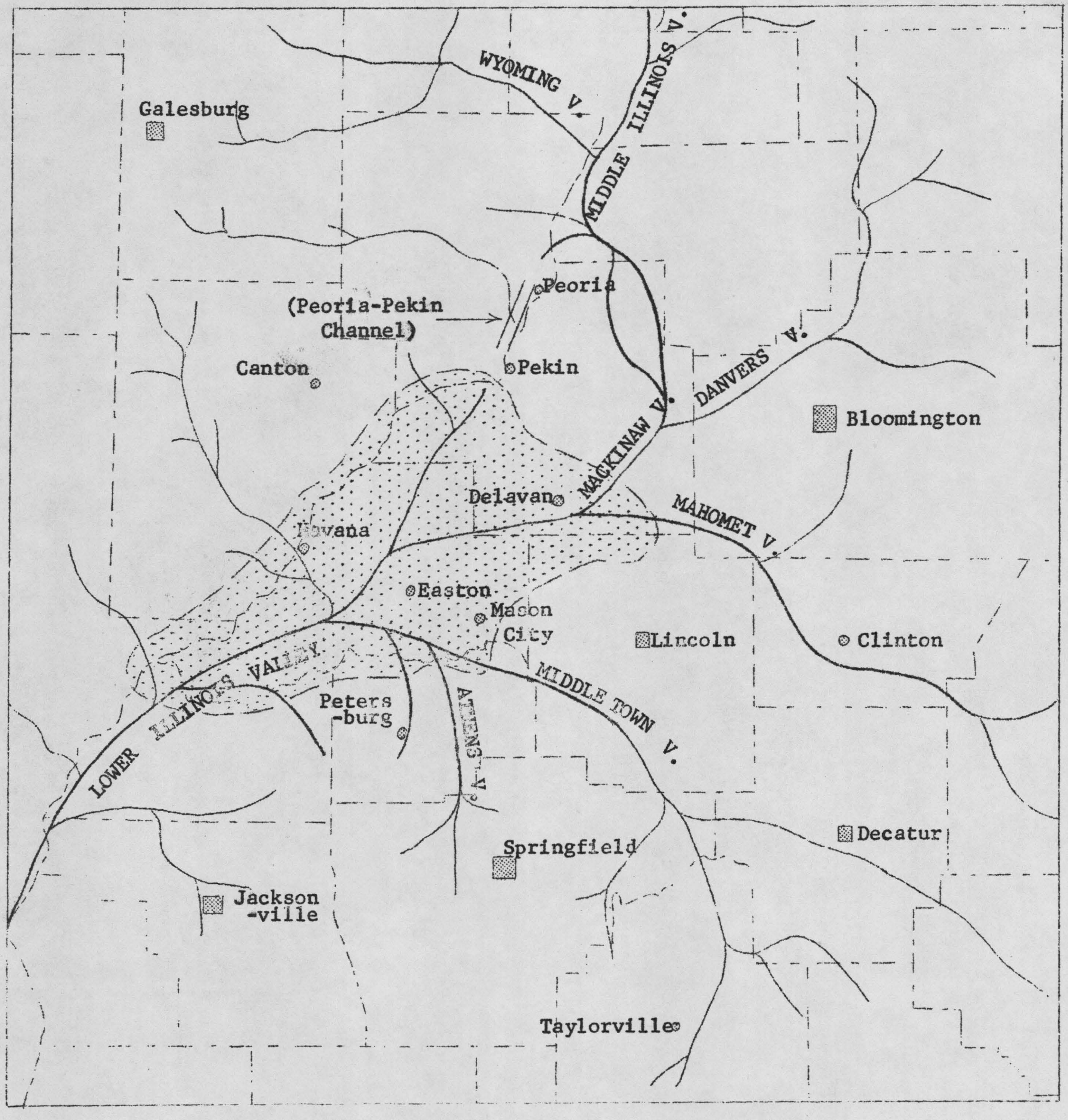


Fig. 3 - Axes of the bedrock valleys of west-central Illinois and location of the Havana Lowland (stippled area).

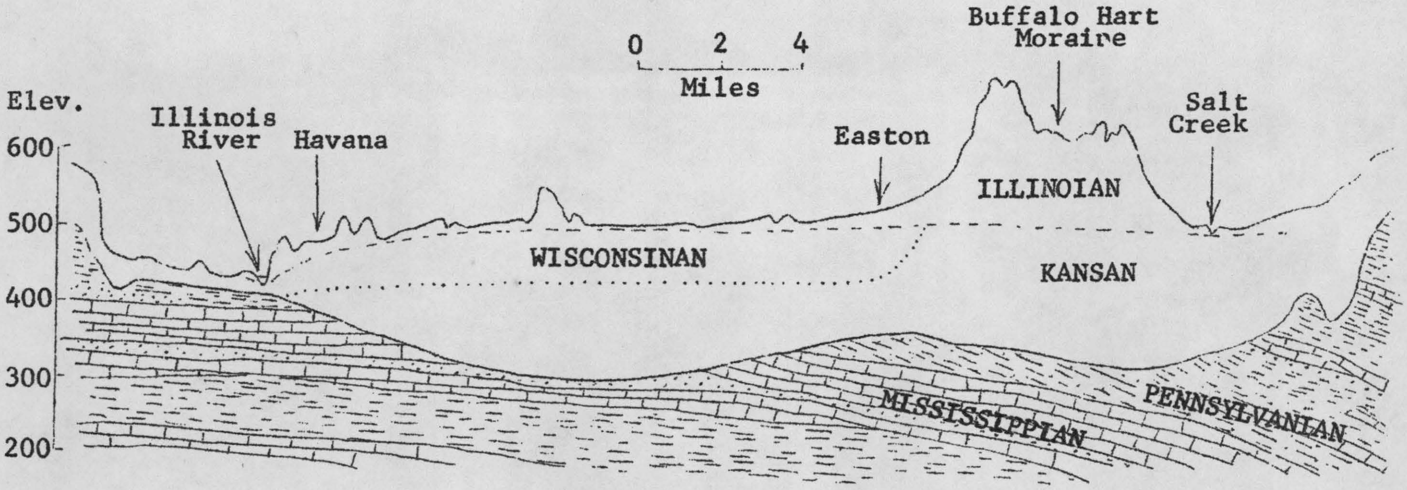


Fig. 4 - Cross section of the Havana Lowland from northwest of Havana toward the southeast across the valley of Salt Creek. The bedrock floor and the unconsolidated deposits are shown diagrammatically. Vertical exaggeration about 95 times.

Kansan and Illinoian Stages has buried the valleys, and at the present time there is little topographic evidence of their former existence. The broad Havana Lowland, through which the present Illinois River flows from Pekin to Beardstown, is a partially buried bedrock feature that retains considerable topographic expression. The lowland was formed by the lateral planation of easily erodable Pennsylvanian sedimentary rocks at the junctions of several of the bedrock valleys.

Erosion of the bedrock valleys and the Havana Lowland was essentially complete when the Kansan glacier advanced into the region. The Kansan glacier advanced from the east and west as two separate lobes, and covered the bedrock valleys and most of the Havana Lowland. Although thick deposits of Kansan drift were deposited in the bedrock valleys, largely filling them (fig. 4), the valleys were not obliterated, and most of the major streams were able to continue their early Kansan courses. The only significant drainage change was the establishment of a diversion channel between the present sites of Peoria and Pekin and the extension of the Middle Illinois Valley to join the Lower Illinois Valley to the southwest. This took place as a result of ice-blockage of the Mackinaw Valley by the eastern Kansan lobe, after which the Mackinaw Valley was largely abandoned and the Peoria-Pekin channel carried most of the drainage from the north. During the Yarmouthian Stage the streams re-excavated their valleys, and the Peoria-Pekin channel was deepened.

During Illinoian time, both the Liman and Jacksonville glacier advanced across the Havana Lowland, and thick deposits of till and outwash were deposited (fig. 4). The Buffalo Hart glacier also advanced into the lowland to a line a few miles south of Havana and extending eastward approximately along the present northern boundary of Menard County. The north bluff of the present Sangamon River in this area marks the approximate limit of the Buffalo Hart glacier (see itinerary map). Before the end of Illinoian time (perhaps before the advance of the Buffalo Hart ice) the bedrock valleys tributary to the Illinois Valley had been completely buried by Illinoian drift. However, the Illinois Valley was not completely filled, and when the ice melted away, it continued to serve as a major drainageway. The present tributary system, including the Sangamon River and Salt Creek, were probably initiated as meltwater streams from the melting of the Buffalo Hart glacier. During the Sangamonian Stage, these streams became established as permanent drainage lines, and at the same time extensive erosion took place along the Illinois Valley and the Peoria-Pekin channel.

At its maximum extent, the Wisconsinan glacier advanced only as far as the present sites of Pekin and Delavan in southeastern Tazewell County. As the Altonian ice (early Wisconsinan) advanced and retreated, more outwash was carried down the Illinois Valley. During the dry seasons, the winds blew very fine sand and silt from the floodplain and deposited it on the adjoining uplands as loess. Similar conditions prevailed throughout Woodfordian time (late Wisconsinan), while the glacier was building the numerous end moraines in northeastern Illinois. During the building of the Bloomington Moraine, one of the largest of the Woodfordian end moraines, the glacier blocked the Illinois Valley at Peoria. An unusually large amount of meltwater flowed down the Illinois Valley and a great outwash fan of sand and gravel, which extends from Peoria to beyond Beardstown, was formed in the Havana Lowland. As the glacier melted back from the Bloomington Moraine, a large meltwater lake (Lake Illinois) became dammed up between the ice front and the moraine. Because the Illinois Valley was choked with outwash, the lake was forced to discharge through a narrow channel along the west side of the Havana Lowland, a course the present Illinois River still follows.

Still later when the ice stood at the position of the Valparaiso Moraine, meltwaters from an extensive ice front in northeastern Illinois, southern Michigan, and northern Indiana were concentrated into the Kankakee Valley and the upper Illinois Valley. Meltwater was produced more rapidly than it could be carried away, and several lakes were backed up between the Wisconsinan end moraines (see attached map of Glacial Geology of Northeastern Illinois). The large overflow from these lakes poured down the Illinois River as a torrential flood, referred to as the Kankakee Flood. The floodwaters deeply eroded the surface of the Bloomington outwash fan, scouring the outwash and building numerous bars of sand and gravel. As the floodwaters subsided, the bars were exposed to the wind and became reworked into dune complexes. Sand gradually spread southeastward forming the dune ridges on the upland bordering the Havana Lowland. Several terraces eroded in the Bloomington outwash record the levels of the floodwaters. Later during Valderan time, further erosion and deepening of the valley took place from the overflow of glacial Lake Chicago. The postglacial Illinois River has been a sluggish stream, and at the present time is aggrading its valley bottom in the central Illinois region.

Itinerary

0.0	0.0	Assemble at Porta Consolidated Community High School on the corner of Seventh Street and West Monroe Street. Proceed east and cross Seventh Street.
		STOP. Intersection with Route 97 and 123 (Sixth Street). Turn left (north) on highway.
0.3	0.3	Intersection with Route 123. Continue north on Route 97. SLOW.
0.5	0.8	Railroad underpass. SLOW. PREPARE TO TURN AT NEXT RIGHT. On the left is an abandoned clay products plant.
		Turn right onto concrete road. CAUTION. Cross railroad tracks and proceed northwest. SLOW. Ascend hill past grain storage bins.
0.6	1.4	Intersection with blacktop from left (south). Follow concrete road around curve to right. Continue north on the Lincoln Heritage Trail.
0.3	1.7	Entrance to Fairground. Continue north.

0.2 1.9 Note the flatness of the upland surface (Illinoian till plain) in this vicinity.

0.4 2.3 Crossroads. Continue north.

0.1 2.4 SLOW. Pavement ends.

1.5 3.9 Crossroads. Continue north.

0.4 4.3 Y-intersection. Continue straight ahead on blacktop. PREPARE TO TURN RIGHT.

0.1 4.4 T-road intersection. Turn right on oiled road.

0.6 5.0 Descend east valley wall of Sangamon River Valley.

0.1 5.1 Y-intersection. Bear left. Note the broad valley bottom of Sangamon River.

As mentioned earlier, the Sangamon River originated as a meltwater stream near the end of the Illinoian glaciation about 200,000 years ago. During Sangamonian time (200,000 to 70,000 years ago), the Sangamon River Valley became established in its present position as a major drainageway on the Illinoian till plain. Later during the Wisconsinan glaciation, the portion of the valley that was covered by the glacier became filled by drift and was obliterated. The present course of the river on the Wisconsinan till plain is post-Shelbyville in origin and was probably cut by meltwaters from the Shelbyville, Cerro Gordo, Champaign, West Ridge, and Bloomington-Normal lobes (see attached map of Glacial Geology of Northeastern Illinois). Therefore, the extension of the valley behind the Shelbyville Moraine was begun no more than about 20,000 years ago. At the same time the older portion of the valley here on the Illinoian till plain was enlarged by the Wisconsinan meltwaters. This difference in the age of the Sangamon Valley behind and in front of the Shelbyville Moraine is reflected to some degree by differences in the valley's size.

1.0 6.1 Turn right (east).

0.2 6.3 SLOW. Cross narrow bridge and turn left (north).

0.5 6.8 Crossroads. CAUTION. Continue ahead north.

1.2 8.0 Stop 1. Wisconsinan terrace of Woodfordian outwash.

The gently undulating surface immediately to the south along the west side of the Sangamon Valley is a terrace that was eroded in the Wisconsinan valley fill sometime after the Bloomington glaciation. Remnants of this terrace can also be seen along the east side of the valley from here. Other terrace remnants occur at several places to the south along Sangamon Valley and to the north and east along the Salt Creek Valley (see itinerary map—stippled areas).

The terrace is low, generally less than 20 feet high, and is not well-defined topographically. In this vicinity the upper surface of the terrace occurs between about 500 and 510 elevation, but farther south along the valley (upstream) the tops of the terrace remnants increase in elevation. The terrace also rises to the east along Salt Fork Valley. The upper surface of the terrace remnants represents the level to which the valleys were filled by outwash from the Woodfordian glacier, probably during the Bloomington glaciation.

The valley of Salt Fork just to the east of its present junction with the Sangamon River is about three times as wide as the valleys to the south and west of the junction. This wide valley is not entirely an erosional feature formed by Salt Fork. Most of the valley south of Salt Creek probably represents the drift-mantled south side of the buried Middletown Valley, which passes north of Greenview from the east to west. The surface expression of this buried bedrock valley is slight, but it can be traced topographically for about eight miles to the east past Greenview to the vicinity of Middletown. Toward the west from here the valley is essentially completely buried, but a slight depression of the upland surface may represent its continuation to the west. An arcuate meander scar in the wall of the Sangamon Valley may have been excavated in the easily erodable valley fill (see itinerary map). The meander scar was cut before the terrace was formed while the meltwater-charged Sangamon River was flowing at a higher level.

0.1 8.1 T-road from right. Turn right (north).

0.5 8.6 T-road from left. Continue straight ahead.

1.1 9.7 Crossroads. Turn left (west).

0.1 9.8 Note the area of sand dunes on the right.

0.5 10.3 One-lane bridge over Latimore Creek. CAUTION. Note the dune sand in the field on the right.

0.7 11.0 T-road intersection. Turn left (south).

0.4 11.4 Stop 2. Discussion of the Woodfordian sand dunes and the Buffalo Hart Moraine.

This stop affords an opportunity to examine more closely the sand dunes that were formed during the Kankakee Flood. The sand ridges, such as this one, which contribute to the irregularity of the topography in this area, were formed by sand blown from the outwash plain of the Havana Lowland during and after the Kankakee Flood. Some of the sand ridges are actually sand dunes and consist entirely of sand, but others are sand-veneered knolls of Wisconsinan loess and/or Illinoian till.

This stop also affords an excellent view of the Buffalo Hart Moraine on the north side of the Sangamon Valley. The moraine, in places rising more than 200 feet above the valley bottom, is a rather impressive topographic feature. The rolling, hummocky topography with numerous kettle holes is typically morainic (see itinerary map). The kettles, some of them water-filled, were formed when blocks of ice became detached from the ice margin and were buried by outwash. The ice blocks melted away, leaving the depressions. Formed at the margin of the glacier where melting was predominant, the moraine consists of a mixture of ice-laid till and water-laid sand and gravel. Much coarse outwash was deposited along the margin of the Buffalo Hart glacier. Several gravel pits have been operated in the front of the moraine directly across the valley from here.

0.1 11.5 T-road from right. Continue south.

0.5 12.0 Crossroads. Turn right (west).

0.1 12.1 STOP. Intersection with blacktop. West branch of Lincoln Heritage Trail. Continue west.

1.2 13.3 Crossroads. Continue west. Note view to right.

0.8 14.1 Stop 3. Area of reactivated sand dunes.

This stop occurs in an area of sand ridges where the sand is being blown by present-day winds. It is possible that reactivation of the dunes has been caused by cultivation of the land within the last few years. The uplands of the Illinoian till plain in this area are well-drained, but are poorly suited to the growing of grain crops because of the extremely sandy soils. This is especially true on slopes. Some examples of erosion can be seen in fields along the itinerary for the next few miles. It would be wiser for farmers to leave the land in grass for grazing and raising crops of hay. A few of the farmers have realized this, and examples of their farms will be seen also.

0.5 14.6 Cross bridge over Tar Creek.

0.1 14.7 T-road from left. Turn left (south).

Stop 4. Exposure of Wisconsinan Loess and dune sand, and Illinoian till.

The sand ridge here has been eroded to reveal Wisconsinan loess beneath the sand. The sand is fine grained and consists predominantly of quartz, but it also contains considerable amounts of feldspar and dolomite, and small amounts of other minerals. The sand is well-sorted and stratified, as is typical of dune sand. It is also somewhat iron-stained and contains a small amount of clay, which causes the sand to feel sticky when wet.

The loess below the sand is compact and chocolate brown in color. It was blown from the surface of the Illinois River valley train during the advance and retreat of the Altonian (early Wisconsinan) glacier in northeastern Illinois. The overlying sand is Woodfordian in age (Shelbyville and younger). The sand and loess are draped over the side of the valley which was cut into the Illinoian till plain prior to their deposition.

Illinoian till is exposed along the bottom of Tar Creek along the northeast side of the valley. The upper contact with the overlying floodplain silts can be seen. The till is steel gray in color, and the upper part which has been truncated by stream erosion is only slightly oxidized. Till is an ice-laid deposit. It is characterized by its lack of sorting and lack of stratification. Note the wide range of particle sizes from clay to pebbles and cobbles in this exposure. Note also the variety of sedimentary, igneous, and metamorphic rock types in the till. Some of the rock fragments are faceted and striated from having been abraded during transport by the ice.

The low elevation of the top of the till, more than 80 feet below the level of the adjacent upland, suggests that it may be Kansan till, not Illinoian.

0.7 15.4 Crossroads. Continue south.

0.6 16.0 T-road from right. Continue south.

0.8 16.8 Crossroads. Continue south.

1.0 17.8 Crossroads at northeast edge of Atterbury. CAUTION. Continue ahead.

STOP. Y-intersection with Route 97. Turn left on highway and proceed southeast.

1.6 19.4 Crossroads. Continue ahead.

1.2 20.6 T-road from left. Continue ahead.

0.3 20.9 Crossroads. Continue ahead.

0.5 21.4 SLOW. PREPARE TO TURN RIGHT AT CROSSROADS.

0.2 21.6 Crossroads. Turn right (south). Cross UNGUARDED RAILROAD CROSSING. TWO TRACKS.

1.0 22.6 STOP. T-road intersection. Turn left on concrete road toward Petersburg.

0.5 23.1 Entering Petersburg. SLOW.

0.3 23.4 CAUTION. Railroad overpass.

0.1 23.5 Y-intersection at Thirteenth Street. Continue straight ahead on Douglas Avenue to Twelfth Street.

Turn right (south) on Twelfth Street. Cross Jackson Street.

0.2 23.7 Cross Monroe Street.

0.1 23.8 Cross Madison Street.

STOP at Jefferson Street. Cross Jefferson and continue south on Twelfth Street.

0.1 23.9 T-intersection with Lincoln Avenue. Turn left (east).

0.1 24.0 STOP. T-intersection with Oakland Avenue from right. Turn right (south) on Oakland Avenue. Cross Adams Street.

0.1 24.1 Washington Street. The northeast corner of the intersection is the site of the home of the poet, Edgar Lee Masters.

0.4 24.5 Entrance to Oakland Cemetery. Ann Rutledge and Edgar Lee Masters are buried here.

Continue straight ahead.

0.4 24.9 T-road from right. Continue south.

0.1 25.0 T-road intersection. Turn left (east). The itinerary is now passing Lake Petersburg, a private lake.

0.4 25.4 CAUTION. Curve. Descend hill.

0.2 25.6 Stop 5. Exposure of glacial drift in southeast abutment to Lake Petersburg Dam.

The valley at the base of the dam is underlain by the Pennsylvanian Farmington Shale Member of the Modesto Formation. The gray, green, and black shales are well exposed along a small gulley near the south abutment of the dam. The Farmington is better exposed at Stop 7 and will be discussed there.

Immediately above the shale is a thick section of Pleistocene drift, including from the bottom upwards Kansan till, Illinoian silt (outwash), Illinoian till (Jacksonville), and Wisconsinan loess. The drift deposits are poorly exposed and rapidly becoming grassed over, so that it is difficult to distinguish the individual units. However, the tops of the two till units are marked by soil zones that can readily be seen. About halfway up the slope the Yarmouth Soil is developed in the top of the Kansan till. The soil is a thin (about four feet) dark, yellow-brown zone with dark manganese stains. The Kansan till below (about 10 feet thick) is yellow-brown, becoming grayer toward the base. The Sangamon Soil occurs in the top of the Illinoian till, below the Wisconsinan loess, about two-thirds of the way up the slope. The soil is a distinctive dark reddish brown to dark brown color with manganese stains. The Illinoian till below is gray-brown, grading downwards to gray.

The Yarmouth and Sangamon Soils were formed during the warm interglacial intervals (Yarmouthian and Sangamonian, respectively) following the Kansan and Illinoian glaciations (see attached Pleistocene Time Table). Buried soils are important marker horizons used by Pleistocene geologists in working out the stratigraphic relations of the glacial deposits. Each buried soil has characteristics that are sometimes recognizable in different exposures, and when used with other criteria, the soils are useful in establishing the relative ages of the deposits. For example, the Sangamon Soil, which marks the warm interval between the Illinoian and Wisconsinan (glacial) Stages, is typically reddish brown in color.

0.0	25.6	Leave Stop 5. STOP. T-road intersection with Route 97. Turn right (south).
0.5	26.1	SLOW. PREPARE TO TURN RIGHT. T-road from right. Turn right and proceed uphill at sign pointing toward Illinois Youth Commission Camp.
0.2	26.3	Illinois Youth Commission Camp on left. Continue straight ahead.
0.1	26.4	Picnic and camp grounds on left.
0.2	26.6	T-road from left. Turn left and enter park grounds near service area buildings. Continue ahead (south).
		<u>Stop 6</u>. Lunch in New Salem State Park.
0.2	26.8	Leave Lunch Stop and proceed south past restored buildings on left. Continue ahead through parking area. SLOW.
0.1	26.9	Turn left at end of parking area and follow arrows to road descending hill. SLOW.
0.2	27.1	CAUTION. Footpath crossing.
0.1	27.2	T-road from left. Bear right. Continue slowly around flagstaff.
0.1	27.3	STOP. Intersection with Route 97. Turn left (north). CAUTION.
0.1	27.4	Cross bridge.
0.1	27.5	<u>Stop 7</u>. Exposure of Pennsylvanian Carbondale and Modesto Formations in roadcut along west side of Routes 97 and 123, south of pedestrian overpass. (See geologic section on page 21.)

All of the bedrock exposures occurring along the field trip itinerary belong to the Carbondale (Kewanee Group) and Modesto (McLeansboro Group) Formations. These formations comprise parts of two cyclothems, the Sparland and the overlying Gimlet.

The Danville (No. 7) Coal Member, the top unit of the Carbondale Formation, and an underclay are exposed in the lower part of the roadcut. The shale above the coal belongs to the Farmington Shale Member, the basal member of the Modesto Formation. Yellow- to red-brown Kansan till (four feet thick) rests on the shale and is overlain by several feet of Wisconsinan loess.

The Danville (No. 7) Coal Member (15 to 16 inches thick) is an excellent marker bed throughout large parts of the area underlain by strata of the Kewanee Group (Middle Pennsylvanian) in Illinois. In this area the Danville Coal lies 20 to 30 feet above the Herrin (No. 6) Coal Member. The No. 6 Coal is near the bedrock surface throughout this region and has reportedly been observed in the bed of the Sangamon River near Petersburg during low water. The No. 7 Coal receives its name from the city of Danville in Vermilion County, where it is well developed and is extensively mined. It is minable along the east edge of Illinois south of Vermilion County and extends eastward into western Indiana, where it also has been widely mined. The No. 7 Coal also attains minable thickness in northern Illinois and in scattered areas in other parts of the state. Frequently, the coal is overlooked in stratigraphic studies, even when drill cores are used, but careful study will almost always reveal an underclay and commonly a thin coal.

The Farmington Shale is about 28 feet thick in this exposure and consists of greenish to gray to brown mudstone and splintery to thin-bedded shale. The shale contains thin bands and nodules of ironstone. A thin bed of platy, black shale occurs about 12 feet above the coal. Black shale also occurs immediately above the coal. The Farmington Shale was at one time mined just to the south across the highway for use in the manufacture of bricks and tile at the plant in Petersburg.

Sedimentary History of the Pennsylvanian Rocks

The Pennsylvanian rocks in the Petersburg area occur on the northwest shelf of the Illinois Basin, a subcircular structural depression 250 to 300 miles in diameter, covering most of Illinois, southwestern Indiana, and northwestern Kentucky (fig. 6). Throughout much of the Paleozoic Era, the Illinois Basin was a slowly subsiding (sinking) region in which many thousands of feet of sedimentary strata were deposited, layer upon layer, in the ancient shallow seas that covered the Midcontinent region.

Pennsylvanian sedimentary rocks form the bedrock surface over approximately four-fifths of Illinois and have a maximum cumulative thickness of about 3000 feet. They were deposited between 270 and 300 million years ago, and contain all of Illinois' minable coal beds, whose recoverable reserves are estimated at 137 billion tons. In 1965, over 58 million tons of coal valued at over $217 million were mined in Illinois, ranking the state fourth among the coal-producing states in the nation. Coal is one of the state's most important mineral resources, accounting for about one-third of the total production value, which in 1965 amounted to approximately $618,500,000.

Unlike the older sedimentary rocks in Illinois, which consist of fairly thick units of limestone, dolomite, sandstone, and shale, the Pennsylvanian strata are made up of comparatively thin rock units, often only a few inches thick and

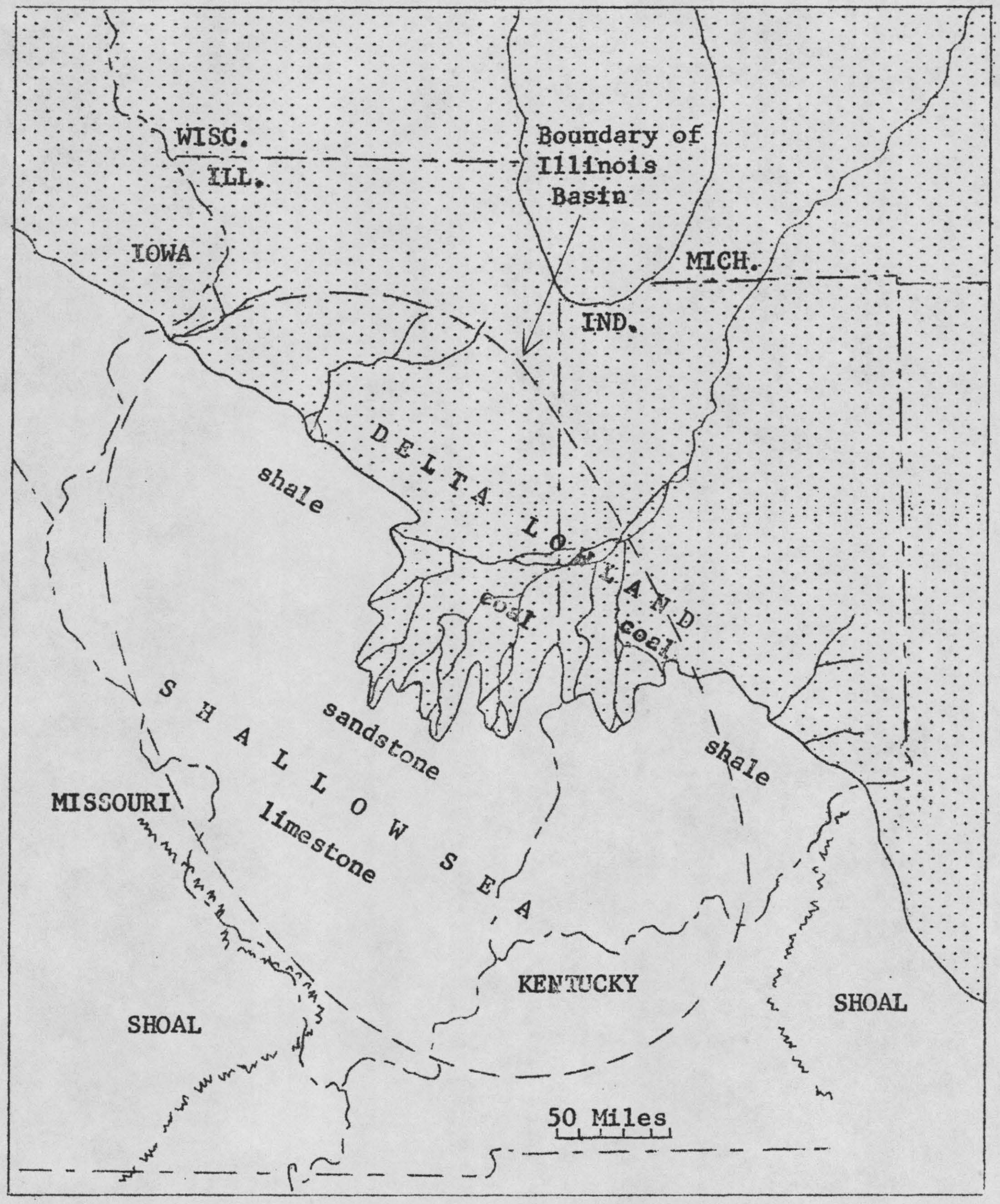


Fig. 6 - Paleogeography of the Illinois-Indiana region during the Pennsylvanian Period.

rarely exceeding 30 feet. They are characterized by frequent and abrupt vertical changes in rock type. Several hundred individual units—sandstone, shale, siltstone, clay, limestone, and coal—are present in the Pennsylvanian System. Many of these individual units are quite variable in thickness and grade laterally from one rock type to another. However, some units, especially the limestones, are very persistent laterally and can be traced over large areas of the state.

About 30 years ago, geologists at the Illinois State Geological Survey noted from their field studies of the Pennsylvanian strata that the various individual rock units occur in regular sequences, which are repeated many times. Each regular sequence represents a cycle of sedimentation during which the individual units were deposited under environmental conditions that changed with time. Each cycle of sedimentation, called a cyclothem, consists of several lithologic units, part of which were deposited under marine conditions and part under nonmarine conditions. Based on extensive studies of the entire Pennsylvanian System in Illinois and the Midwest, the geologists determined that an ideally complete cyclothem consists of ten distinct sedimentary units. The attached chart shows the arrangement of units in the ideal cyclothem. Only a few of the approximately 50 cyclothems that have been described in Illinois contain all ten units. Usually one or more units are missing, but the order of arrangement is almost always the same. The units that are most commonly present are a basal sandstone overlain by an underclay, coal, black slaty shale, limestone, and gray shale.

The variety of sedimentary rock types in the Pennsylvanian System, the thinness of individual units, the abrupt and frequent vertical changes in rock types, and the lateral variations in thickness and lithology of most units, indicate a wide range of depositional conditions which changed fairly rapidly with time. The cyclical character of the sedimentary sequences also indicates that the depositional conditions during Pennsylvanian time changed in a regular manner. The geologic framework which produced these conditions is not exactly known, but it was unique to the Pennsylvanian Period, because no other system of sedimentary rocks in the geologic column exhibits a comparable development of cyclic sediments.

Geologists have offered several explanations for the Pennsylvanian cyclothems, too numerous and detailed to discuss at the present time. It is clear that the presence of both marine and nonmarine deposits in each cyclothem requires that invasion and withdrawal of the sea occurred during the formation of each cycle. The repeated alternations of marine and nonmarine sedimentary rocks also indicate that there were many intervals of invasion and withdrawal. In general, the sandstone-underclay-coal portion (the lower 5 units) of each cyclothem is nonmarine and was deposited on coastal lowlands from which the sea had withdrawn. However, some of the sandstones are entirely or partially marine. The units above the coal are marine sediments which were deposited during the invasion part of the cycle. The exact mechanism which caused these repeated relative changes in sea level is not known, but the occurrences of cyclic Pennsylvanian sediments on many of the continents suggests that the sea level fluctuations were world-wide. The following discussion briefly explains the geologic conditions that probably existed in the Illinois-Indiana region during the Pennsylvanian Period.

At the end of the Mississippian Period, the sea withdrew from the Midcontinent region, and an interval of erosion took place during early Pennsylvanian time. During this erosion interval, many hundred feet of Upper Mississippian strata were stripped off in central Illinois, and an ancient Pennsylvanian river system, flowing across Illinois toward the southwest, cut deep channels into the Mississippian formations. The erosion was then interrupted by the invasion of the Pennsylvanian sea.

For the remainder of Pennsylvanian time the Illinois Basin region was a broad swampy lowland bordering the shallow sea which lay to the southwest (fig. 6). This lowland stood only a few feet above sea level, so that only slight changes in relative sea level caused great shifts in the position of the shoreline. A slight rise in sea level would have caused submergence of the low borderland, followed by marine deposition, and conversely, a slight lowering would cause emergence of the lowland and much of the shelf of the Illinois Basin, followed by nonmarine deposition.

The Pennsylvanian river system, which flowed across the low borderland from the northeast, carried mud and sand from northern highlands and built a great delta out into the sea. Throughout Pennsylvanian time the Illinois Basin continued to subside, and along with the world-wide sea level changes, this caused the position of the shoreline to change continually. Oscillations of the delta front and the resultant rapidly changing depositional conditions produced the striking variations in the Pennsylvanian rocks.

At various times conditions at any place on the shallow sea floor favored the deposition of sandstone, limestone, or shale. Sandstone was deposited near the mouths of distributary channels. These sands were reworked by waves and spread as thin sheets near the shore. The shales were deposited in quiet water areas—in delta bays between distributaries, and in deeper water beyond the nearshore zone of sand deposition. Limestone, which formed by chemical precipitation from the sea and the accumulation of limy shells of marine plants and animals, were usually deposited farther from shore than the sandstone and shale, but some limestone was formed in nearshore areas where little sand and mud were being deposited. The areas of sandstone, shale, and limestone deposition continually changed as the position of the shoreline changed and as the delta distributaries extended seaward or shifted their positions laterally along the shore.

The nonmarine sandstones, shales, and limestones were deposited on the deltaic lowland bordering the sea. The nonmarine sandstones were deposited in distributary channels, in river channels, and on the broad floodplains of the rivers. Many of the channel sands are preserved as elongate channel deposits in the cyclothems. Some of these sand bodies, 100 or more feet thick, cut through many of the underlying rock units. The shales were deposited mainly on floodplains. Fresh-water limestones and some shales were deposited locally in fresh-water lakes and swamps. The coals were formed by the accumulation of plant material, usually where it grew, beneath the quiet waters of extensive swamps. Lush forest vegetation, which thrived in the warm, moist Pennsylvanian climate, covered the region. The origin of the underclays beneath the coals is not exactly known, but they were probably deposited in the swamps as slack-water muds before and during the formation of the coals. The formation of coal marked the end of the nonmarine portion of the depositional cycle. Resubmergence of the borderland by the sea interrupted nonmarine deposition, and the marine portion of the cyclothem was then laid down over the coal.

Origin of Coal

It is generally accepted that the Pennsylvanian coals originated by the accumulation of vegetable matter, usually in place, beneath the waters of extensive, shallow, fresh to brackish swamps. They represent the last-formed deposits of the nonmarine portions of the cyclothems. The swamps occupied vast areas of the deltaic coastal lowland, which bordered the shallow Pennsylvanian sea. A luxuriant growth of forest plants, many quite different from the plants of today, fluorished in the warm Pennsylvanian climate. Today's common deciduous trees were not present, and the flowering plants had not yet evolved. Instead, the jungle-like forests were dominated by giant ancestors of presently-existing club-mosses, horsetails, ferns, conifers, and cycads. The undergrowth also was well developed, consisting of many ferns, fernlike plants, and small club-mosses. Most of the plant fossils found in the coals and associated sedimentary rocks show no annual growth rings, suggesting rapid growth rates and lack of seasonal climatic variations. Many of the Pennsylvanian plants, such as the seed ferns, became extinct.

Plant debris from the rapidly growing swamp forests, composed of leaves, twigs, branches, and logs, accumulated as thick mats of peat on the floors of the swamps. Normally, vegetable matter rapidly decays by oxidation to water, nitrogen, and carbon dioxide. However, the cover of swamp waters, which were probably stagnant and low in oxygen, prevented the complete oxidation and decay of the peat deposits.

The periodic invasions of the Pennsylvanian sea across the coastal swamps killed the Pennsylvanian forests and initiated marine conditions of deposition. The peat deposits were buried by marine sediments. Following burial, the peat deposits became gradually transformed into coal by slow chemical and physical changes in which pressure (compaction by the enormous weight of overlying sedimentary layers), heat (also due to deep burial), and time were the most important factors. Water and volatile substances (nitrogen, hydrogen, and oxygen) were slowly driven off during the coalification process, and the peat deposits were changed into coal.

Coals have been classified by ranks which depend on the degree of coalification. The commonly recognized ranks of coal, in order of increasing rank, are (1) brown coal or lignite, (2) sub-bituminous, (3) bituminous, (4) semibituminous, (5) semianthracite, and (6) anthracite. Each higher rank is characterized by increasing amounts of fixed carbon and decreasing amounts of oxygen and other volatiles. Hardness of coal also increases with increasing rank. All of Illinois' coals are bituminous.

Underclays occur beneath most of the coals in Illinois. Because underclays are generally unstratified (unlayered), are leached and possess a bleached appearance, and generally contain plant roots, many geologists consider them to represent the old soils on which the coal-forming plants grew.

The exact origin of the carbonaceous black shales which occur above many coals is uncertain. The black shale may represent a deposit which formed under restricted marine (lagoonal) conditions during the initial part of the invasion cycle, when the region was still closed off from the open sea. The lagoons were quiet water areas where very fine, iron-rich muds and finely-divided plant debris were washed in from the land. The high organic content of the black shales is also in part due to the carbonaceous remains of plants and animals that lived in the lagoons. The fossil remains of animals in the black shales are typically, although not always, depauperate (dwarf) because they were stunted by toxic conditions in the sulfide-rich waters of the lagoons. The phosphatic siderite nodules, which occur in the black shales, were formed by chemical precipitation of calcium carbonate, iron carbonate (siderite), and phosphate from the brackish lagoonal waters. These features suggest slow rates of shale deposition.

0.0 27.5 Leave Stop 7. Continue ahead on Route 97.

0.2 27.7 Grist mill on right. Continue ahead. SLOW. PREPARE TO TURN RIGHT.

0.2 27.9 Intersection with Athens Road. Turn right (east) and cross Sangamon River.

0.3 28.2 T-road from left. Continue straight ahead.

2.2 30.4 Crossroads. Continue ahead (east).

1.6 32.0 T-road from left. Continue straight ahead.

0.2 32.2 T-road from right. Continue straight ahead.

2.2 34.4 Athens city limits. SLOW. Note spoil pile of abandoned coal mine on the left across the railroad tracks.

0.4 34.8 T-road intersection. STOP. Turn left (north).
RAILROAD CROSSING. CAUTION. Continue ahead on North Main Street.

0.5 35.3 T-road from right. Turn right (east).

0.8 36.1 STOP. Intersection with Route 29. Turn left and proceed north on Route 29.

1.8 37.9 Indian Point Cemetery on right. SLOW. PREPARE TO TURN.

0.4 38.3 Crossroads. Turn right onto blacktop.

0.4 38.7 Stop 8. Exposure of Pennsylvanian Modesto Formation in Doyle and Pottorf Indian Point Limestone Products quarry. (See geologic column on page 21.)

Bedrock units exposed in the quarry belong to the Modesto Formation of the McLeansboro Group (Upper Pennsylvanian) of Illinois. These units comprise part of the Gimlet Cyclothem and perhaps part of the Cutler Cyclothem (roughly equivalent to the Sparland Cyclothem noted at Stop 7).

The 12 feet of bedrock exposed in the lower part of the quarry face is a medium to thick bedded, gray, mottled limestone that is quite fossiliferous. The top one foot of this unit is a limestone conglomerate. About 10 feet of gray, light greenish-gray, and reddish variegated shales have been observed in a sump beneath the limestone at this locality.

Above the limestone conglomerate are about four inches of medium dark gray, thinly laminated, sandy siltstone which contains a considerable amount of carbonized plant fragments, some of which are several inches long. About one foot of medium gray claystone occurs on top of the siltstone.

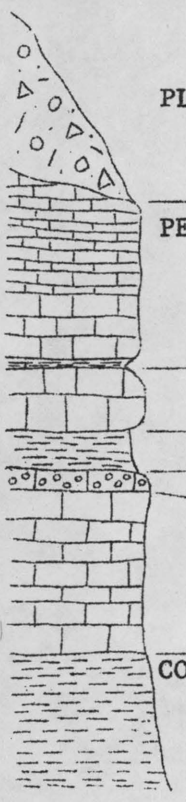
The upper 11 feet exposed in the quarry face consists of about two feet of dark gray, dense limestone (calcilutite) at the base, overlain by one foot of dark gray limestone containing pink crinoid stem fragments. On top of these two lower limestone units is a three-inch, dark greenish-gray to black, fossiliferous shale. The remainder of the upper unit (about 8 to 10 feet) consists of a dark greenish-gray, mottled, crinoidal limestone that is thick bedded to massive in the lower part and thin bedded in the upper part.

Stratigraphic correlation of the limestones exposed here is uncertain. The upper limestone units probably represent the Lonsdale Limestone Member of northern and western Illinois. The Lonsdale is thought to be equivalent to the West Franklin Limestone Member of southeastern Illinois. The lower bench may be the Piasa Limestone Member of southwestern Illinois. The Piasa has been traced laterally into the area just south of Springfield where there is good control data available. However, from the Divernon-Springfield area northward, the subsurface control is sparse and correlation remains uncertain. The variegated shales noted previously are characteristic of the clays and shales occurring beneath the Piasa to the south and west.

There is some feeling that perhaps all of the limestone exposed here is the Lonsdale. If this is true and the correlation of the lower bench with the Piasa can be established, then it would appear that the Piasa of southwestern Illinois represents a lower bench of the West Franklin of southeastern Illinois.

End of Field Trip

DRIVE CAREFULLY ON YOUR WAY HOME



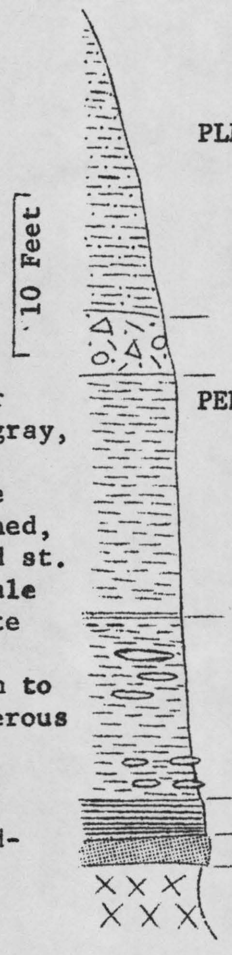
PLEISTOCENE
- undifferentiated

PENNSYLVANIAN
- gray-green shale over dark greenish gray to gray, mottled, thin bedded, fossiliferous limestone
- dark gray, fine-grained, limestone; pink crinoid st.
- gray carbonaceous shale
- limestone conglomerate

- gray, mottled, medium to thick bedded, fossiliferous limestone

COVERED
- gray, green, and red-mottled shale

Section exposed at Stop 8.



PLEISTOCENE
Wisconsinan
- brown loess becoming dark red-brown near base; grades to and mixed with colluvium at base; calcareous concretions

Kansan
- yellow-gray to red-brown till

PENNSYLVANIAN
Farmington Shale
- gray to green to brown shale; becomes more evenly bedded downwards

- thin, fissile, black shale

- gray-green shale with bands and nodules of ironstone; becomes darker gray downwards

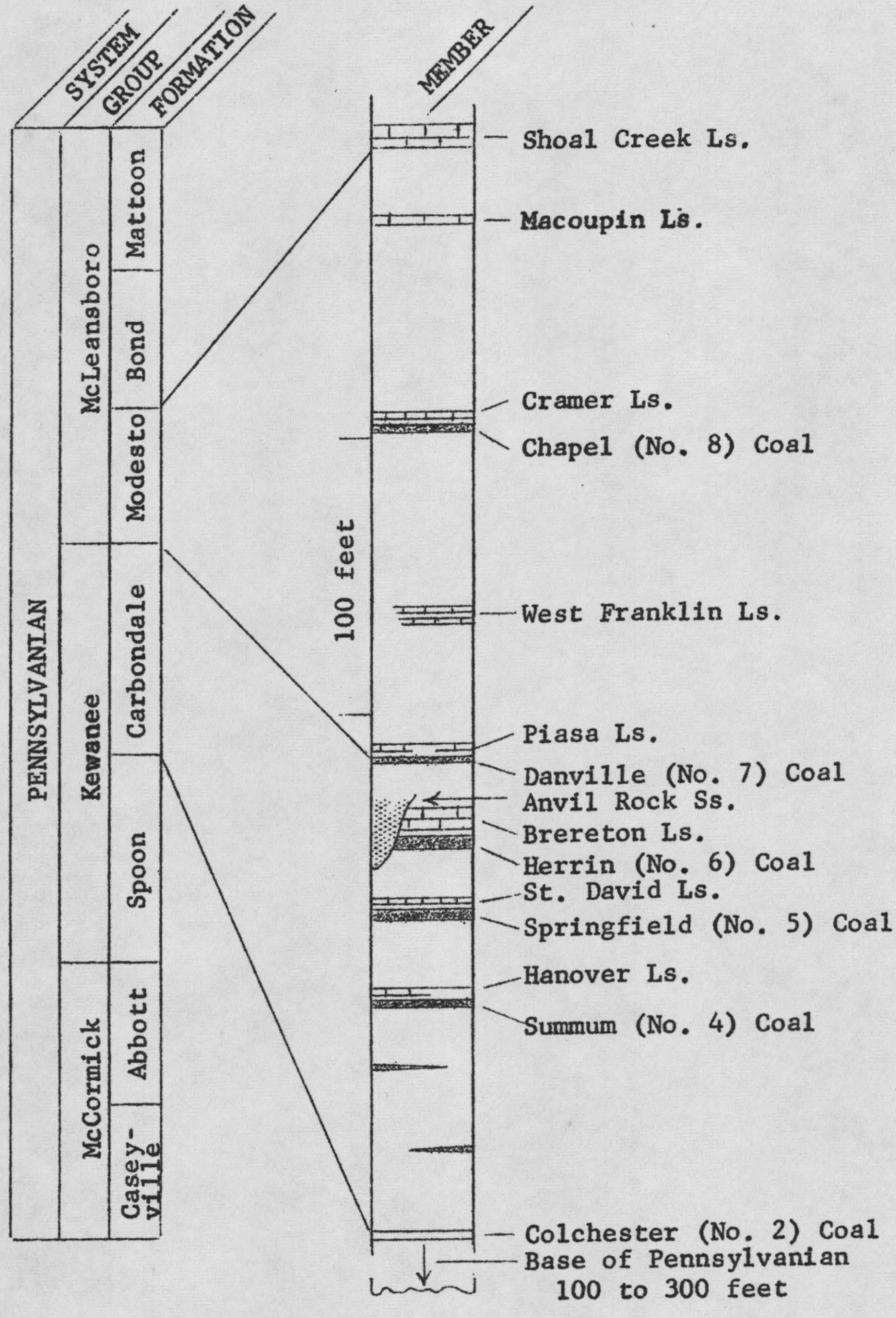
- papery black shale

Danville (No. 7) Coal

Underclay
- medium gray with sulfur streaks

Section exposed at Stop 7.

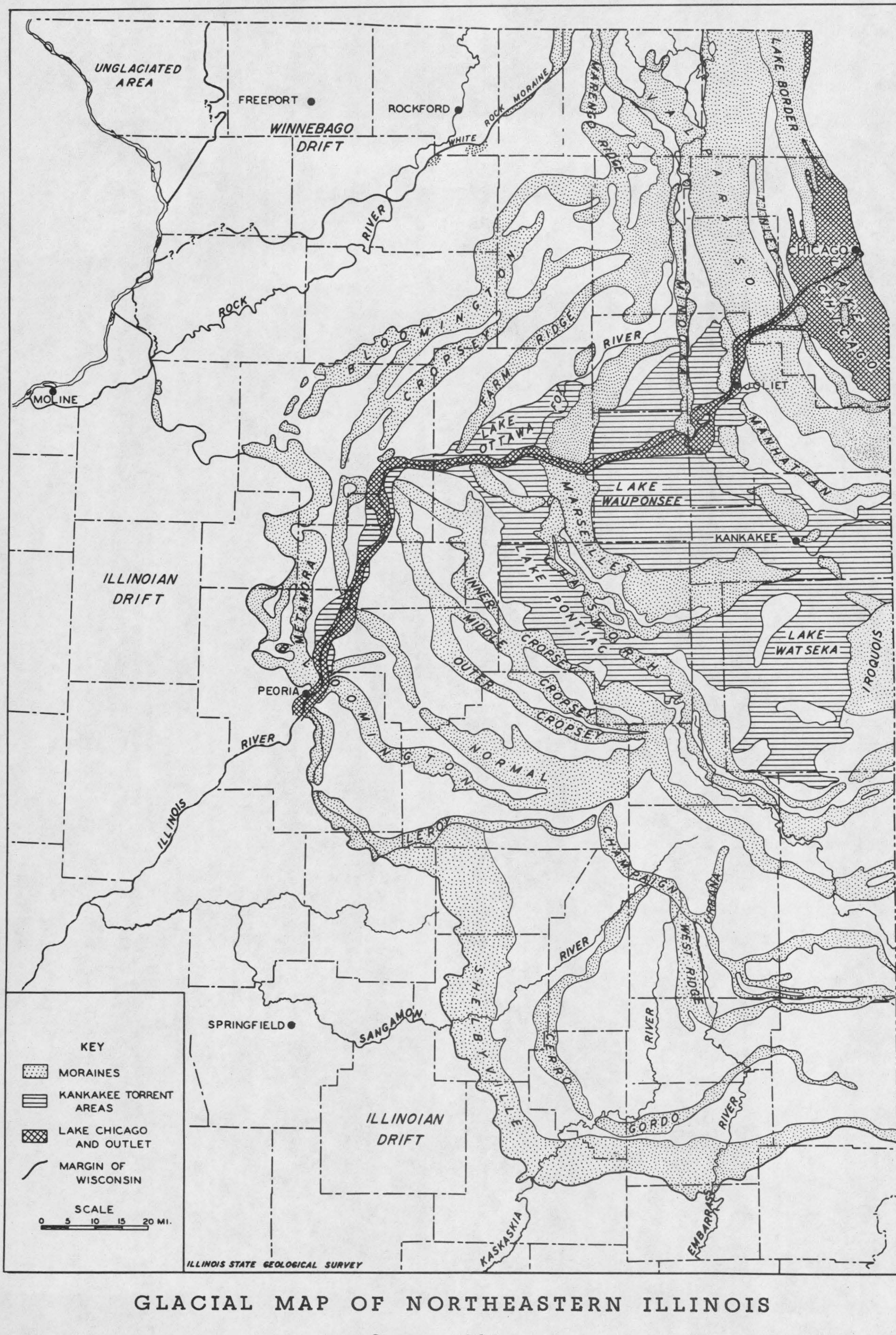
GENERALIZED GEOLOGIC COLUMN OF THE PENNSYLVANIAN SYSTEM SHOWING THE KEY UNITS PRESENT IN WEST CENTRAL ILLINOIS



TIME TABLE OF PLEISTOCENE GLACIATION

STAGE	SUBSTAGE	NATURE OF DEPOSITS	SPECIAL FEATURES
RECENT	Years Before Present	Soil, youthful profile of weathering, lake and river deposits, dunes, peat	
	5,000		
WISCONSINAN (4th glacial)	Valderan	Outwash	Outwash along Mississippi Valley
	11,000		
	Twocreekan	Peat and alluvium	Ice withdrawal, erosion
	12,500		
	Woodfordian	Drift, loess, dunes, lake deposits	Glaciation, building of many moraines as far south as Shelbyville, extensive valley trains, outwash plains, and lakes
	22,000		
	Farmdalian	Soil, silt, and peat	Ice withdrawal, weathering, and erosion
	28,000		
	Altonian	Drift, loess	Glaciation in northern Illinois, valley trains along major rivers, Winnebago Drift
	50,000 to 50,000		
SANGAMONIAN (3rd interglacial		Soil, mature profile of weathering	
ILLINOIAN (3rd glacial)	JUBILEEAN	Drift	Glaciers from northeast at maximum reached Mississippi River and nearly to southern tip of Illinois
	MONICAN	Drift	
	Liman	Drift	
YARMOUTHIAN (2nd interglacial)		Soil, mature profile of weathering	
KANSAN (2nd glacial)		Drift, loess	Glaciers from northeast and northwest covered much of state
AFTONIAN (1st interglacial)		Soil, mature profile of weathering	
NEBRASKAN (1st glacial)		Drift	Glaciers from northwest invaded western Illinois

(Illinois State Geological Survey, 1970)

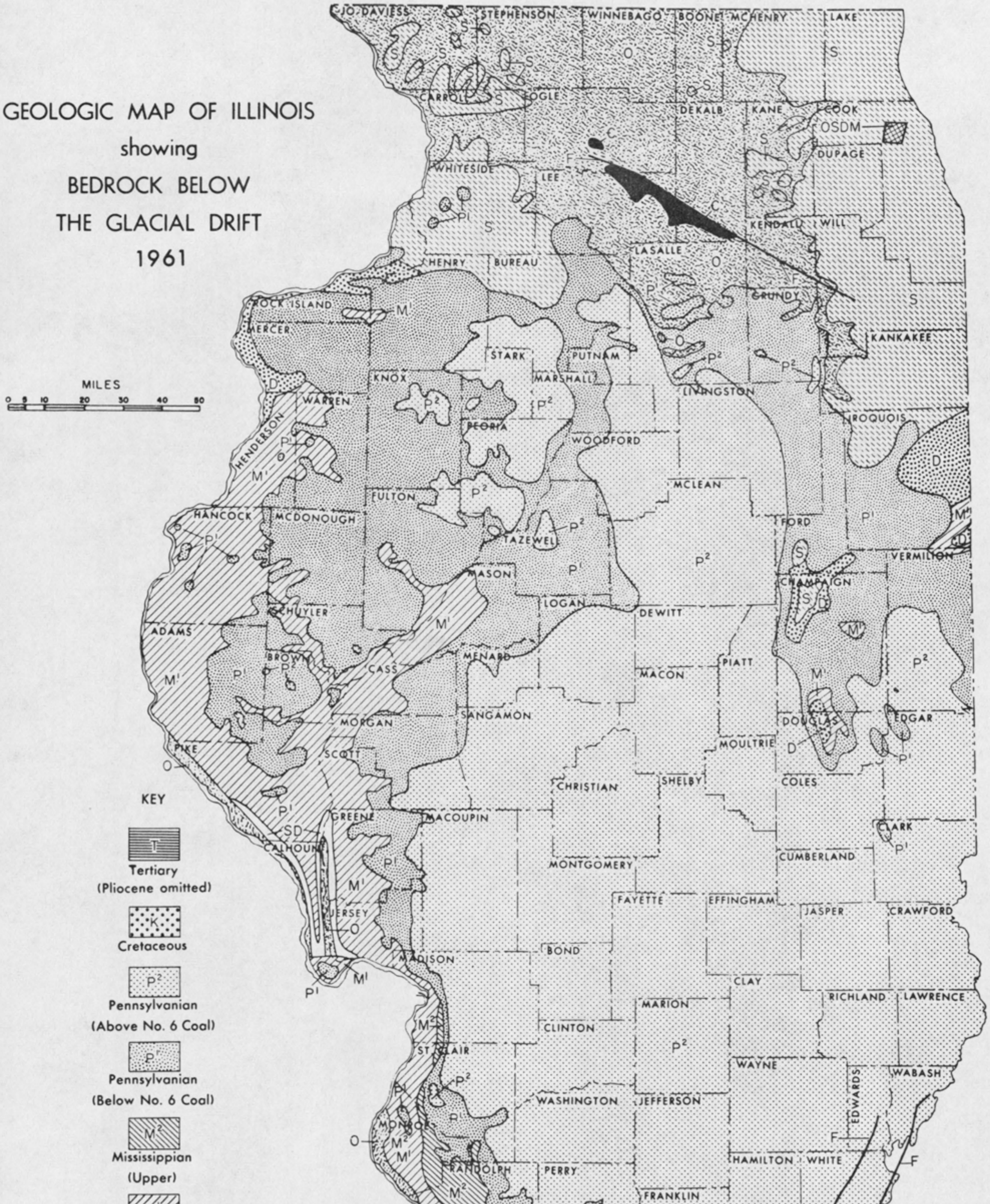


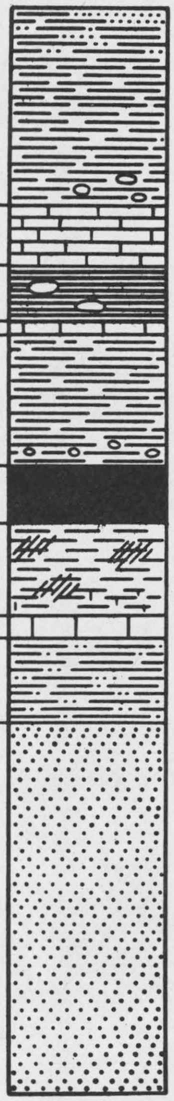
GLACIAL MAP OF NORTHEASTERN ILLINOIS

George Ekblaw

Revised 1960

GEOLOGIC MAP OF ILLINOIS
showing
BEDROCK BELOW
THE GLACIAL DRIFT
1961





10 Shale, gray, sandy at top; contains marine fossils and ironstone concretions, especially in lower part.

9 Limestone; contains marine fossils.

8 Shale, black, hard, laminated; contains large spheroidal concretions and marine fossils.

7 Limestone; contains marine fossils.

6 Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

5 Coal; locally contains clay or shale partings.

4 Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

3 Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

2 Shale, gray, sandy.

1 Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)

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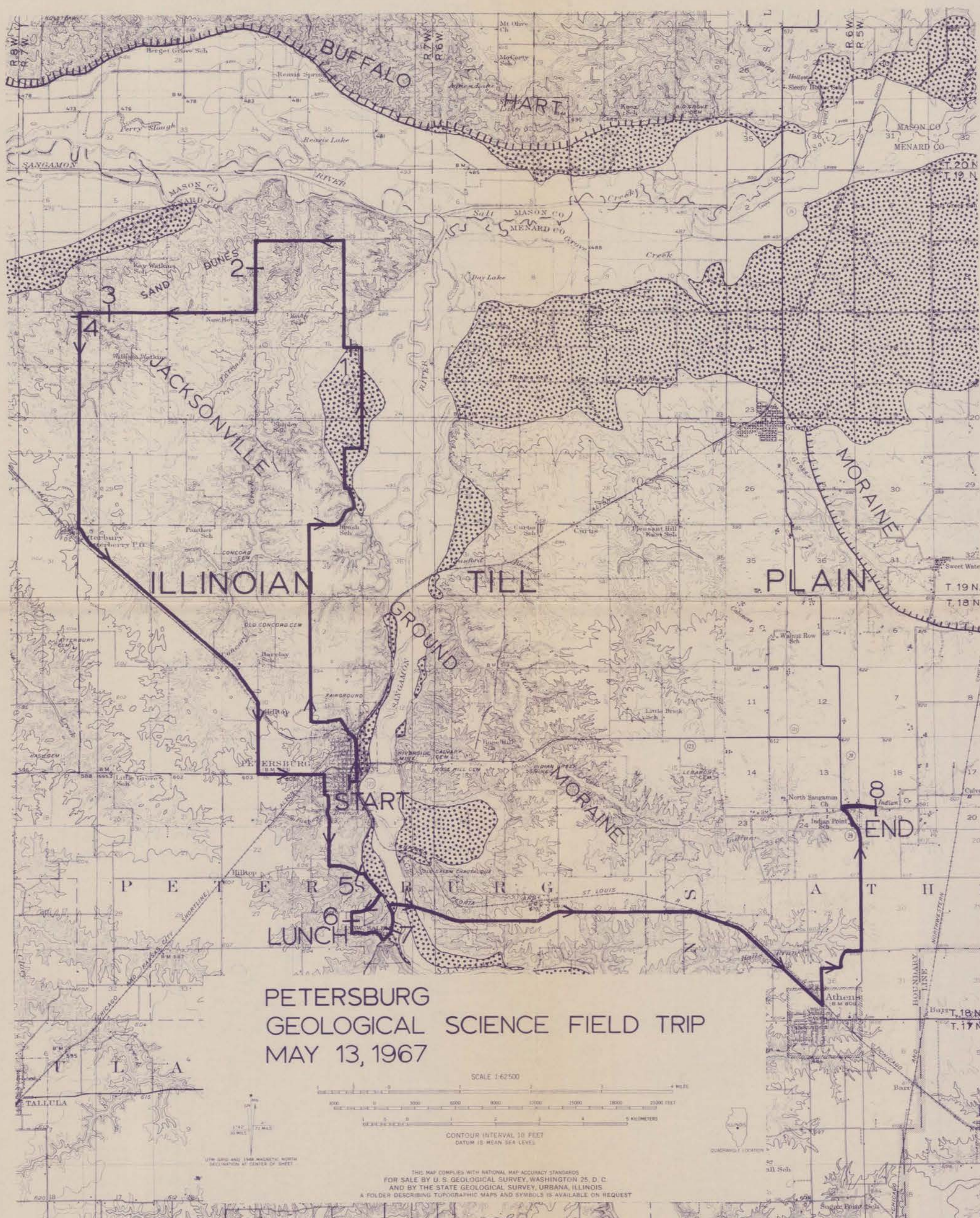
PETERSBURG
GEOLOGICAL SCIENCE FIELD TRIP
MAY 13, 1967
BUFFALO HART MORAINE
SAND DUNES
JACKSONVILLE MORAINE
ILLINOIAN TILL PLAIN
GROUND MORAINE
START
LUNCH
END
1
2
3
4
5
6
7
8
SANGAMON RIVER
MASON CO
MENARD CO
PETERSBURG
Athens
TALLULA
T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
R. 8 W.
R. 7 W.
R. 6 W.
R. 5 W.
SCALE 1:62500
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.
AND BY THE STATE GEOLOGICAL SURVEY, URBANA, ILLINOIS
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST